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CHANGING THE VP RESERVE READINESS SYSTEM TO MATCH THE CREW-COORDINATION REQUIREMENTS OF RESERVE AIRCREWS

by

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The current VP readiness system promotes long-term, fixed crews with TACNUC rules. Adhering to these crew composition rules can cause considerable scheduling difficulties for reserve squadrons. Squadron readiness officers are often forced to change events, pick different crews, or turn the event into a practice session due to last minute civilian commitments of SELRES crewmembers.

This thesis examines current crew-coordination research to determine the value of keeping crews together. The study proposes alternatives to the current TACNUC rules and analyzes their perceived impact according to SME interviews.

This study recommends discarding the TACNUC rules in favor of a readiness system based on individual qualifications. The desired crew-coordination training can be accomplished through the ongoing TPC and ACT programs. Standardization of crew communication patterns and positional task expectancies should continue so that each individual crewmember can perform well on any crew.

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CHANGING THE VP RESERVE READINESS SYSTEM TO MATCH THE CREW-COORDINATION REQUIREMENTS OF RESERVE AIRCREWS

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EXECUTIVE SUMMARY

Historically, reserve VP squadrons have supported active duty squadron deployments while obtaining yearly readiness qualifications. Recently, the VP community has specifically been identified as a force area where reserves could be used more in peacetime contributory support. The subsequent increased interaction between reserve and active VP forces has led to a similar readiness system.

The current VP readiness system promotes long-term, fixed crews with TACNUC rules. These rules require four tactically essential crewmembers present for initial readiness qualifications and three of four present for yearly currency qualifications. Adhering to these crew composition rules can cause considerable scheduling difficulties for reserve squadrons. Squadron readiness officers are often forced to change events, pick different crews, or turn the event into a practice session due to last minute civilian commitments of SELRES crewmembers. Subject Matter Experts (SMEs) interviewed estimated that as much as 50% of scheduled events are typically affected.

Previously, these TACNUC constraints have been viewed as an acceptable cost of doing business with the premise that crews who flew together often, would become more familiar and commit fewer tactical or safety errors.

This thesis examines current crew-coordination research to determine the value of keeping crews together. The study proposes alternatives to the current TACNUC rules and analyzes their perceived impact according to SME interviews. This study also presents crew attributes for a typical reserve squadron as compared to its active duty counterpart. As expected, reserve crewmembers showed more experience in terms of both individual flight hours and months since

initial positional qualification. Reserve crewmembers also tend to stay in the same squadron and on the same crew much longer than active duty crewmembers.

Early crew composition research indicated that crews who had flown together before performed better than those who had never flown together. However, current crew composition research, on long-term, fixed crews, indicates that performance and safety *decreases* over time. The Air Force and Army studies cite overfamiliarity, complacency, and a less explicit crew-coordination style as factors explaining mixed crews outperforming fixed crews.

Accordingly, this study recommends discarding the TACNUC rules in favor of a readiness system based on individual qualifications. The desired crew-coordination training can be accomplished through the ongoing TPC and ACT programs. Standardization of crew communication patterns and positional task expectancies should continue so that each individual crewmember can perform well on any crew. Discarding the current TACNUC rules is expected to promote a more explicit crew-coordination environment. Explicit crew-coordination improves mission effectiveness, as well as, the overall safety of flight operations.

Changing the TACNUC policy has the additional benefit of increasing training resource efficiency. SMEs interviewed predict associated squadron readiness levels will increase as much as 30-40 % with relaxed TACNUC restrictions.

I. INTRODUCTION

With the end of the Cold War, U.S. military forces began a process of mission assessment and force reductions that continues today. Although most of the personnel reductions (right sizing) are complete, a redesign of the roles and missions needed to meet the new threats is ongoing. A key element in this aspect of force planning is the new roles and missions reserve forces will assume. There is a trend, among all the services, to de-emphasize the reserve's mobilization role and increase the amount of peacetime augmentation of active duty forces. This shift has occurred for two main reasons:

- Active duty force reductions have left fewer active forces to meet the world-wide operational commitments, making reserve augmentation an attractive option.
- In an era of decreasing defense budgets, utilizing reserves has been viewed as a "return on investment" of the dollars spent training reservists during their prior active duty careers.

As this shift swept through the DoD, the Maritime Patrol (VP) community was in the process of changing its readiness system. In 1995 both reserve patrol wings adopted the new readiness system used by active duty VP squadrons. In an effort to promote a seamless Total Force, the reserve patrol wings made very few changes to the active duty system (the only major differences reflecting equipment specific to reserves vice active duty). One of the objectives this new readiness system is to encourage squadrons to leave their twelve man P-3 crews together longer and go through the qualification process as a crew rather than as individuals. This emphasis on crew coordination is an extension of safety research (Kanki and Foushee, 1989) which showed that some mishaps, on multi-crewed airplanes, could be

avoided through crew coordination training. Research further indicated that military effectiveness of a crew also increased with crew coordination training (Povenmire, Rockway, Bunecke, and Patton1989). With this in mind, the readiness system developed forced active duty squadrons to qualify their crews during the home cycle with the same crew list that they would later use throughout a deployment.

The new system seemed to translate well to typical reserve operations prior to their increased amount of peacetime (Contributory) support (CS). Before the heavy emphasis on CS began, a typical VP reserve squadron would send half of the squadron to a forward deployed site for two weeks each summer. The other half of the squadron would report to the same site for the following two weeks. During this one month period, reserve crews would fly "direct support" for the active duty squadron deployed at the same site. These flights were primarily training flights that the reserve crews used to get their yearly qualifications. Keeping crews together was not particularly difficult since the crews were away from their civilian commitments for the entire two weeks. At the end of this "active duty" month, the reserve squadron would leave with many crews fully qualified for the entire upcoming year.

While the new readiness system was being implemented, active duty VP force structure cuts demanded even greater use of reserve forces to supplement the day-to-day active duty operations. This changed typical reserve squadron deployed operations by making reserve crews more a part of the day-to-day operations. It also decreased the amount of independent training opportunities reserve crews could complete during their two week active period.

One drawback of using VP reserves more throughout the year, was that their readiness began to deteriorate by one to two readiness categories[1]. While contributory support allows for some excellent real-world training opportunities, the operations rarely involve all mission areas. The OASD reserve report acknowledges this point by stating,

> While participation in active duty missions generally provides excellent training for aviation and support units, some drawbacks do exist, especially in combat aviation. In many instances, the missions flown during ongoing peacetime contingency operations fulfill only a small portion of the aircrew's training requirements. Extended periods of supporting active missions results in the crews falling behind in total training requirements, and an extended period may be required for crew members to return to previous readiness status. (OASD Reserve Affairs Homepage)

The decrease in diverse training opportunities while deployed means that reserve squadron training officers now need to gain the bulk of their crew's qualifications during drill weekends rather than the two week annual training period. For reserve squadron training officers, accomplishing these qualifications, while meeting the new readiness system's crew coordination rules has become quite an incredible challenge. Under the current system, an unexpected sickness or civilian work requirement of one key crew member often turns a long planned qualification event into a practice session (freeplay) with no associated readiness points[2].

This thesis focuses on how the change in reserve operations has affected meeting

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[1] According to SME interviews detailed on page10-11.

[2] A squadron training officer may first attempt to re-assign the qualification to a different crew however, other crews may not need the particular qualification or may not be available on short notice.

readiness requirements for the reserve patrol squadrons. More specifically, this study examines the balance between the crew coordination rules within the VP readiness system and each squadron's ability to schedule and complete their crew's readiness qualification events.

The readiness system modifications examined by this study attempt to ease some of the scheduling difficulties caused by the crew coordination rules yet, minimize any loss in crew coordination training. This study also points out some of the differences between the typical active duty crewmember and the typical reserve crewmember in terms of time in position, time in squadron, time on current crew, previous experience etc. These differences may have implications for the crew coordination training needed for active crews vs. reserve crews.

A. INCREASED USE OF RESERVE FORCES

1. Force-wide increase

The increase in peacetime reserve use previously mentioned is certainly not unique to VP forces rather, it reflects a trend among all services to incorporate reserve forces into daily world-wide commitments. The increase in contributory support was primarily driven by the DoD Bottom-Up Review recommendations and the congressionally-mandated Commission on Roles and Mission Study's conclusion:

> In the future, the role of the reserves will increase in importance, particularly as a critical element in deterring potential enemies who might try and take advantage of a situation when we are engaged in a major regional contingency. If deterrence fails, the reserves must provide the forces that will enable us to fight and win. (RAND, 1992 p.296)

The use of reserves in operations supporting active duty forces has become more than an operational trend. Instead, reserve forces are now an integral part of most ongoing

operations. For example, the Honorable Deborah R. Lee. Assistant Secretary of Defense for Reserve Affairs, speaks of the Reserve's new role:

> Although the wartime role of the reserve forces is very important, I want to underscore the importance of the peacetime support role the reserves are playing today, as well as the importance of this role for the next twenty five years.
>
> We are currently in one of the busiest and most complicated periods of peace our military has ever known. While the bulk of a major military downsizing is behind us, budgets remain tight and the tempo of day-to-day military operations remains high. As a result, the National Guard and reserve have a tremendous opportunity to do more and to demonstrate how effectively they can support the peacetime operations of the Total Force. (raweb.osd.mil/docs/esgrm8.htm)

This evolution of roles has had a great impact on how all reserve units operate on a day-to-day basis and on how they measure their contribution to the Total Force. With more active force integration, reserve forces have had a greater pressure to mirror their active duty counterparts in both equipment and training. Reserve forces also now spend a much greater percentage of their budgeted training time on active component support. In fact, compared to other reserve branches, the shift has been most dramatic for the Naval Air Reserve Force. The table below shows the reserve component percentage of annual training(AT), active duty for training (ADT), and inactive duty for training(IDT) allocations dedicated to the support of the active component missions for Fiscal Year 1994 through Fiscal Year 1996.

Training Dedicated to Active Component Support

Service	FY 94	FY 95	FY 96
Army National Guard			
Annual Training, (AT)	11%	11%	11%
Active Duty for Training, (ADT)	6%	6%	6%
Inactive Duty for Training	1%	1%	1%
Army Reserve			
Annual Training, (AT)	5%	5%	5%
Active Duty for Training, (ADT)	3%	3%	3%
Inactive Duty for Training	2%	2%	2%
Naval Reserve (Air)			
Annual Training, (AT)	**50%**	**60%**	**80%**
Active Duty for Training, (ADT)	**60%**	**72%**	**85%**
Inactive Duty for Training	**10%**	**13%**	**30%**
Naval Reserve (Surface)			
Annual Training, (AT)	50%	72%	76%
Active Duty for Training, (ADT)	60%	75%	85%
Inactive Duty for Training	10%	15%	35%
Air National Guard			
Annual Training, (AT)	35%	40%	45%
Active Duty for Training, (ADT)	60%	65%	70%
Inactive Duty for Training	2%	2%	2%
Marine Corps Reserve			
Annual Training, (AT)	15%	18%	45%
Active Duty for Training, (ADT)	19%	22%	22%
Inactive Duty for Training	1%	1%	1%
Air Force reserve			
Annual Training, (AT)	28%	28%	28%
Active Duty for Training, (ADT)	70%	70%	70%
Inactive Duty for Training	2%	2%	2%
Coast Guard Reserve			
Annual Training, (AT)	77%	79%	90%
Active Duty for Training, (ADT)	77%	79%	90%
Inactive Duty for Training	64%	66%	90%

(OASD Reserve Affairs Homepage)

2. Increased use of VP Reserve Forces

The close similarity between VP reserve and active duty squadrons made the VP community a prime target for downsized active forces and an increased role for the reserve component. VP forces were specifically mentioned in former Senator Sam Nunn's congressional budget testimony.

> ...Currently a third of the P-3 fleet is operated by reserve units. By most accounts, they perform the ASW mission very well, even though they are given the oldest and least capable aircraft. Transferring modern P-3's to Navy reserve P-3 squadrons and deactivating some active squadrons could save between $1.5 and $1.8 billion over five years. (S. Nunn remarks before Congress. 20 April 1990)

a. Flexible drilling

In 1994 Admiral Tom Hall, then Chief of Naval Reserves, introduced a concept of 'flexible drilling'. The goal of flexible drilling, as stated by Admiral Hall was,

> ...to refocus the requirements to devote drill deck and Annual Training time from specific mobilization requirements and change direction to allow Reservists to perform day-to-day tasks appropriate to their rank and skill level. (Naval Reservist, November 1996. pg 1.)

The Naval reserve policy statement discusses flexible drills by mandating;

> All echelons throughout the Naval Reserve will ensure that every effort is made to perform the maximum number of AT and IDT periods at the gaining command consistent with available funding. Maximum flexibility will be employed to schedule these periods so they support peacetime support needs of the gaining command consistent with the attainment of the requisite readiness status. (available online U.S. Naval Reserve homepage)

Flexible drilling encourages reserve unit commanders to lump together two-day drill periods into longer periods so that reserve members can spend these drills on deployed contributory

support rather than only training in the local area. For VP reserve crews this meant flying out to a deployed VP site to offer plane and aircrew rather than conducting training in the local area.

b. Increase in VP contributory support

Reserve VP wing training officers indicated that CS contribution required of each reserve squadron has increased dramatically. In late 1994 reserve squadrons were required to provide the wing with two to four "crew weeks"[3] per squadron. Today each squadron is tasked to provide a minimum of 22 crew weeks and frequently asked for up to 26 crew weeks. For the Atlantic reserve patrol wing this sums to a total of two planes and two aircrews 44 weeks per year. The active fleet is now pressuring for a full two aircraft and two aircrew year-round commitment.

B. GOALS AND OBJECTIVES

The goal of this study is to investigate tradeoffs between the current crew composition constraints, or crew coordination 'rules', in the VP reserve readiness system with the scheduling difficulties they create. In a time of limited budgets every effort should be made to examine the true value of each step in any military process. If one views the readiness qualification as a process, it is important to assess whether the crew coordination rules really provide a benefit equal to or greater than their associated costs.

Since no readiness system or method of training is really an end unto itself, the real goal is to provide a better product to the fleet and to better use limited training resources.

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[3] Crew weeks are a measurement of manpower and are an entire P-3 aircrew for seven days

Therefore, this study attempts to link current crew coordination research to the VP readiness system and to suggest improvements that will maximize efficiency while minimizing any loss in quality of training.

C. SCOPE AND LIMITATIONS

This study is not designed to be a comprehensive analysis of the VP reserve readiness system. It is presented as a starting point in recognizing some of the differences between VP reserve crews and their active duty counterparts and how their differences should shape readiness training and crew coordination training. This study attempts to apply known crew coordination studies from other communities to the current VP readiness system. Although this study discusses differences between active duty and reserve crews, it is understood that the final trained and qualified product--a combat ready aircrew--should have nearly the same capabilities whether or not the crew is active or reserve. Therefore, this study addresses the training involved in producing a reserve crew that can meet its active duty support requirements.

This study is primarily conducted through interviews with subject matter experts (SME's). Future studies should attempt to quantify and test the ideas presented in this thesis. Also, in the interest of keeping the study unclassified, specific squadron readiness levels are not mentioned. Alternatives will discuss the percentage increase in readiness expected by squadron training officers without mentioning the squadron's specific readiness level.

D. RESEARCH QUESTIONS

Primary Research Question:

What are the tradeoffs between the current readiness system's crew

coordination rules considering the scheduling problems and missed training they create for reserve squadrons?

Subsidiary Questions:

1. How has the increase in reserve peacetime (contributory) support affected readiness training and the crew qualification process?

2. Is there a significant experience difference (measured by time in squadron and time in position etc.) between active and reserve crews?

3. What is the scheduling impact (canceled events and lost qualification opportunities) of the crew coordination rules on reserve crews?

4. Can the new Tactical Proficiency Course (TPC) system replace or compliment the crew-coordination aspects of the current readiness qualification process?

5. What is the political feasibility and impact of changing the Navy reserve VP readiness system.

E. METHODOLOGY

There were two phases to this research effort. First, a focus group interview was conducted with active duty VP personnel available at the Naval Postgraduate school. The focus group format was modeled after *Focus Group Interviews in Education and Psychology* (Vaughn, Schumm, and Sinagub, 1996). The purpose of this group interview was to gain an active duty perspective of how reserves have historically interacted with their active duty counterparts and discuss the perceived impact of future increases in reserve contributory support. The members interviewed had all worked with reserves at many levels ranging from first-tour Lt, department head, Tactical Support Center (TSC) commander, up to Wing commander.

Building on the focus group results, reserve Subject Matter Experts (SME) were

interviewed following the guidelines presented in *Talking it Over: Research With Human Sources* (Bednarz D. and Wood, D. 1991). In person and telephone interviews were conducted with current and former reserve squadron commanding officers and wing Chief of Staffs. At this higher rank level the interviews were primarily *information interviews* as defined by Bednarz and Wood. Next, *in-depth interviews* were conducted with current and former Wing training officers and squadron training officers. All interviews were *semi-structured*[4] and the initial questions mirrored this study's subsidiary research questions:

1. How has the change of squadron operations due to increased fleet contributory affected the crew readiness qualification process?

2. What are the differences between a typical reserve crew member from his/her active duty counterpart?

3. Which crew coordination rules within the readiness system are the most challenging to meet?

4. How should the TPC system fit into the current VP readiness system?

5. What are the likely impacts of this thesis's proposed changes?

F. ORGANIZATION

This thesis is divided into six chapters. Chapter I gives a general background of recent trends in the use of reserve forces. Chapter I also defines what this study attempts to accomplish and acknowledges any limitations. It also gives the reader an understanding of the environment in which the examined policy exists and the thought process used to examine the issue.

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[4] For further discussion on information interview, in-depth interview, and semi-structured format see (Bednarz and Wood p. 117-119)

Chapter II reviews the history of crew resource management (CRM) studies. Other service's crew composition studies are summarized and their applicability to the VP readiness system are discussed.

Chapter III gives an overview of the recent past and current VP force structure for both active and reserve forces. The different crew members on a VP crew are described, explaining their duties and rank. Typical crew attributes (time on crew, time in position, total flight time, etc.) are compared for an active duty squadron versus a reserve squadron. This chapter highlights some of the experience differences between active duty crew members and their reserve counterparts.

Chapter IV explains the current VP readiness system and defines the crew coordination aspects built into the system. The chapter also gives an overview of the Tactical Proficiency Course (TPC) which also has an impact on VP crew coordination training. Lastly, the alternatives developed for this study are defined and explained.

Chapter V presents the SME interview findings. Within this chapter, three criteria are used to analyze the study's alternatives; anticipated increase in squadron readiness, perceived impact on crew coordination, and the political feasibility of implementing the change.

Finally, Chapter VI provides the VP reserve community with some recommendations for improving the current readiness system. It specifically addresses the crew coordination aspects of the readiness system and how training resources might be better utilized without a significant loss in crew coordination.

II. LITERATURE REVIEW

A. HISTORICAL OVERVIEW OF CREW COORDINATION

The study of crew coordination or cockpit resource management (CRM) has a relatively short history in aviation. The real beginning was a 'kickoff' workshop held at the NASA Ames Research center in 1979. Also in 1979, two important studies indicated a need for CRM training. Ruffell Smith (1979) studied the effect of workload on performance and noted that crew effectiveness was related to the crew's overall decision making, leadership, and resource management. In another study, John Lauber (1979) identified over 60 airline accidents that were directly attributed to a breakdown in crew coordination. These studies, combined with public pressure concerning commercial aviation safety, led the air carrier industry to move beyond technical flying skills training and address crew interaction. In many cases, airline companies instituted CRM programs after high-profile CRM related accidents. For example, KLM's CRM course following the Pan Am/KLM crash in 1977 and the 1985 Delta accident in Dallas which prompted Delta to create a CRM training program (Jensen, 1995).

For many reasons the military aviation community was slow to follow the CRM trend. Technologically, the military did not have the 'black box' equipment to record the final moments of a crash. Therefore, many possible CRM related military accidents causes were left as undetermined. There was also far less public outcry for increasing the safety of military flights since a much smaller amount of people were typically affected. Also an important organizational difference is that an airline company can dictate a training policy for its entire

company while the military has many different aircraft commands and individual squadrons with differing missions and training needs (Prince and Salas, 1993). The differences between military and civilian CRM requirements were highlighted in the joint NASA and Air Force Military Airlift Command CRM workshop. Cavanagh and Williams (1987) noted six categories of differences: purpose of the organization, qualifications of the crews, rank distinctions, responsibilities of the crew, and labor relations. Despite these significant differences, military aviation did see that CRM principles could improve the safety of its operations and by the late 1980's each service had some type of CRM program.

Within the Navy, CRM training was a Naval Safety Center initiative in response to human error being identified as a causal factor in many accidents. The Navy CRM program was renamed aircrew coordination training (ACT) and was very similar to the commercial airline Flight Deck Management (FDM) program. The subject areas for this training were policy and regulation, command authority, communication, available resources, workload performance, decision making, situational awareness, and operating strategy. The program was implemented Navy wide by having each squadron designate two instructors. These instructors were then given ACT instructor training which supplied them with the materials and the know-how to give a two day ACT seminar to their squadron (Prince and Salas 1993).

The program has evolved further and now includes seven basic ACT skills and behaviors as defined by the Naval Training Systems Center;

- Communication

- Assertiveness
- Mission Analysis
- Decision Making
- Situational Awareness
- Adaptability/Flexibility
- Leadership

The new instruction defines the purpose of ACT by stating, "practicing ACT principles will improve mission effectiveness and reduce mishaps that result from poor crew coordination". (OPNAVINST 1542.7A, p. 1)

Two points stand out when looking at the evolution of Navy ACT training. First, ACT has moved from a 'safety only' focus and has extended ACT to include mission effectiveness. Second, the course has progressed from an attitude change emphasis to behavioral skills training. This shift allows for more comprehensive measurement of specific coordination behaviors which are then used to develop realistic line-oriented simulator scenarios. (Prince and Salas, 1993)

B. CREW COMPOSITION STUDIES

Traditionally the military has approached crew coordination on two fronts; standardized training in CRM and assigning crews to fly together permanently (often called battle rostering). While many studies have validated the positive impacts of standardized training alone, or in combination with permanent crew assignment, there has been little research on crew assignment effects alone. One reason for this lack of research is that the

permanent crew assignment option is primarily a military one. With decreased scheduling flexibility and the overall increased cost of permanent pairings, the airline industry has not had any real interest in researching the long term effects of permanent crew assignments.

Two particular studies, one military and one civilian, have lead most people to assume that flying together as a permanent crew does improve performance and safety. Kanki and Foushee (1989) used a high-fidelity flight simulator to observe the communication pattern of crews who had *never* flown together versus crews who had flown together. Their analysis, using communication indexed crew interaction, concluded that crews who had flown together showed improved information exchange and committed fewer crew errors. Although this conclusion seems to be intuitively obvious, it is important to remember that the study compared crews who had never flown together with those who had (never vs. occasional). It did not compare those who had flown together occasionally with crews who were permanently assigned together (occasional vs. permanent). Within a military squadron, comparing a battle rostered crew with a mixed crew would more closely match the occasional vs. permanent comparison. It would be unusual in a VP squadron to pick a mixed crew that had never flown together. The Kanki study also fails to address any negative effects, such as overconfidence and complacency, that may come from flying on a more permanent basis.

Another widely quoted crew coordination work is the B-52 study by Povenmire, Rockway, Bunecke, and Patton(1989) which measured bomb accuracy of permanently assigned B-52 crews who had been given CRM training. The researchers concluded that operational performance was positively correlated with CRM training. This study was significant in that CRM training could now be applied to the entire tactical crew for improved

operational performance rather than only the flight crew for improved safety.

With the B-52 and Kanki study in mind, military aviation squadrons focused on crew coordination through more permanent crew rostering and squadron-wide CRM training. The VP community addressed both areas with its 1995 readiness system's focus on crew rostered qualifications and the TPC[5] course's emphasis on CRM type tactical training.

While the military aviation community took CRM and battle rostering to heart, aviation accident investigation reports coupled with anecdotal data suggested that battle-rostering was potentially having a negative impact on the safety of operations. A subsequent Air Force study on military transport accident rates concluded that mixed crews were significantly safer than battle rostered crews (Woody, Mckinney, Barker, & Clothier 1994).

In 1994 the Army decided to research the specific impact of battle-rostering independent of the known positive effects of squadron-wide crew coordination training (Simon and Grubb, 1994). The study was conducted using twelve two-man AH-64 crews with one pilot and one copilot gunner on each crew from three squadron's battle rostered crew list. All 24 crewmen had been through the Army's aircrew coordination training so that battle rostering effect alone could be studied. These original 24 crewmembers were randomly paired to form twelve mixed crews. All aviators conducted two missions on their battle-rostered crew and two missions on a mixed crew in the AH-64 combat mission simulator. Crew performance was analyzed in terms of crew behaviors, task performance, mission performance, and flight safety as measured by instructor pilots.

[5] The Tactical Proficiency Course and the VP 'battle rostered' qualification process are discussed in Chapter IV.

The study concluded that battle-rostered crews did not perform any better than their mixed crew counterparts in navigation, threat avoidance and evasion, in-flight emergencies and malfunctions. Only one performance area, gunnery, showed a slight positive effect for battle-rostering. Additionally, simulator exit surveys indicated complacency and overconfidence among the battle rostered crews.

> Battle-rostered crews overrated their performance 50% more than did mixed crews. Crewmembers and IP evaluators commented that overconfidence can lead to complacency. Crewmembers rated their crew coordination style as more implicit when in a battle-rostered crew than when in a mixed crew. Implicit crew coordination coupled with overconfidence is a potentially detrimental combination with adverse effects on mission performance and flight safety. (Simon and Grubb, 1994, p. 47)

Comparing this study to the Kanki and Foushee study shows that there is a non-linear relationship between the number of flights together as a crew and the safety and performance of a crew. While flying together a few times may decrease safety and performance errors, more permanent crew pairings seem to increase the errors. What could be described in figure one as a 'Familiarity Cycle' seems to occur.

Though the exact number of errors with an associated number of flights has not been determined, the Simon and Grubb study clearly shows negative results from a permanent

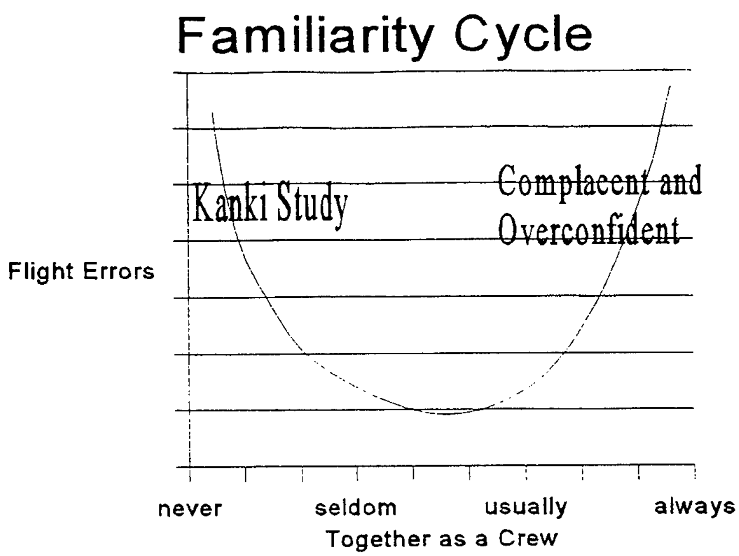


Figure 1

battle-rostering policy. As a result of the Simon and Grubb study, the Army changed its battle-rostering policy (Appendix A). The Army now focuses its crew coordination effort on squadron-wide CRM training and has left battle-rostering as a unit commander's optional risk management tool.

III. VP FORCE INTRODUCTION

A. GENERAL OVERVIEW OF VP FORCES

The Navy's VP force currently includes 12 active duty and 8 reserve VP squadrons. Both active and reserve squadrons currently operate the fleet's newest patrol aircraft, the P-3C. The VP community is unique among Naval aviation communities in that the integration of active duty and reserves is easier. First, both active and reserve squadrons support the same missions and operate nearly identical platforms. Second, they require aircrew integration for proficiency, and though forward deployed, squadrons are land-based. Third, the high experience level of an average P-3 reserve crew makes them comparable in mission effectiveness to an active duty crew.

The history of the VP community can be traced back some 40 years. During this period of time the community has flown several variants of aircraft from the P-2V Neptune to the P-3 Orion. These aircraft have been used in various missions including; surface surveillance, mining, search and rescue (SAR), anti-surface warfare (ASUW), and anti-submarine warfare (ASW). The final mission on this list was especially important during the Cold War where P-3's were constantly flown against Soviet ballistic missile and fast attack submarines in a high-stakes game of cat and mouse. The VP community garnered a reputation as being particularly effective at the ASW mission. As a result, the VP community is known throughout the military almost exclusively for its ASW prowess.

The VP Community's Cold War success in the ASW arena has become a community trademark--one which to this day serves as both a blessing and a curse. While many naval

decision makers are aware of the ASW role, few realize the variety of missions being performed today. As a result, some critics of the VP force feel the VP community is no longer a necessity. Meanwhile, the Commonwealth of Independent States (CIS) continues to build and deploy a serious number of front-line ballistic missile and fast attack submarines each year. Also, the proliferation of submarine technology throughout the third-world continues to pose a future ASW concern. In addition, many overlook the fact that the VP community is currently called upon to perform a number of non-ASW missions around the world.

Despite the increase in operational commitments, the VP community has seen a dramatic decrease in its end strength numbers. The height of the Reagan defense buildup in 1988 marked the apex in strength for the VP community with 24 active duty and 13 reserve squadrons. Beginning in FY-88 the VP community began to undergo a series of inevitable changes as a result of the military-wide downsizing. Consequently, the FY-97 total VP force has been reduced to 12 active duty fleet squadrons and 8 reserve squadrons. This force structure has gone even below the "glide slope" of the original 13 active duty and 9 reserve squadrons proposes in the CNO's FY-97 Navy budget. The figures below show a breakdown of the active duty and reserve VP squadrons as of FY-97 as compared with those in FY-88.

FY-88 vs FY-97 Active Duty VP Squadrons by Location.

LOCATION	FY-88 SQUADRONS	FY-97 SQUADRONS
NAS Moffett Field, CA	VP-9, 19, 46, 47, 50	None
NAS Barbers Point, HI	VP-1, 2, 4, 17, 22 and 40	VP- 4, 9 and 47
NAS Brunswick, ME	VP-8, 10, 11, 23, 26 and 44	VP-8, 10, 11* and 26
NAS Jacksonville, FL	VP-16, 24, 45, 49, 56	VP-5, 16 and 45
NAS Whidbey, WA	None	VP-1, 40 and 46
Note: * Squadron conversion to reserve Maritime Reconnaissance (VQ) underway		

FY-88 vs FY-97 Reserve VP Squadrons by Location.

LOCATION	FY-88	FY-97
NAS Whidbey, WA	VP-69	VP-69
NAS Moffett Field, CA	VP-91	VP-91
NAS Point Mugu, CA	VP-65	VP-65
NAS New Orleans, LA	VP-94	VP-94
NAS Glenview, IL	VP-60 and 90	None
NAS Memphis, TN	VP-67	None
NAS Detroit, MI	VP-93	None
NAS Jacksonville, FL	VP-62	VP-62
NAF Andrews, MD	VP-68	None
NAS Willow Grove, PA	VP-64 and 66	VP-64 and 66
NAS South Weymouth, MA	VP-92	None
NAS Brunswick, ME	None	VP-92

The wholesale series of disestablishments of active and reserve VP squadrons between FY-88 and FY-97 has left the VP community as a shadow of its former self. For the active duty and reserve forces these reductions represent a decrease in end-strength of 50 and 38 percent, respectively. Despite these decreases, world-wide VP commitments remained nearly constant. In order to meet the commitments active duty squadrons increased their reliance on reserve augmentation.

B. VP CREWMEMBER PROFILES

A crew of eleven (five officers and six enlisted) make up a standard P-3 crew. The five officer crew positions are the three pilots, Patrol Plane Commander (PPC), second pilot (2P) and third pilot (3P), a tactical coordinator (TACCO), and a navigator/communicator (NAVCOMM). The enlisted crew consists of two flight engineers (FEs), two acoustic operators (SS1 & SS2), a non-acoustic operator (SS3), and an in-flight technician (IFT). Each crewmember performs positional specific tasks which support the overall mission of the crew. Though each crewmember's specific tasks vary greatly, depending on mission profile and any special equipment installed, a general framework of positional roles and responsibilities can be described.

There are two physical pilot seats in the P-3 and three pilots assigned to a standard crew. This 'extra' pilot allows for seat rotation to reduce crew fatigue Crew fatigue is an important safety concern in the VP community, considering that a full mission can include a three hour pre-flight and over ten hours airborne. Among the pilots, the PPC is senior and is responsible for the safe operation of the aircraft throughout the mission. In addition to the safe operation of the aircraft to and from base, the PPC is

tactically responsible to best position the aircraft for optimal sensor performance and effective buoy/weapon drops. The 2P and 3P serve as a backup to the PPC and are in-training to become PPCs.

The FE sits between the pilots and functions as the non-tactical aircraft systems expert. With the numerous indicator lights, gauges, and circuit breakers, to monitor, the FE serves as the 'inside observer' while the pilots physically fly the aircraft. The second FE is assigned to the crew for seat rotation and is typically in training to become a fully qualified FE.

The senior of the two Naval Flight Officers (NFO) assigned to the crew is the TACCO. The TACCO, as the name implies, is responsible for coordinating the entire tactical effort. At his station the TACCO receives input from all the sensor stations and directs the most effective use of the aircraft's tactical systems, sonobuoys, and weapons.

The other NFO is the NAVCOMM who is responsible for the accurate navigation of the aircraft, logging the aircraft's geographical position throughout the mission, tactical communications, and assisting the TACCO. The NAVCOMM is typically in the training syllabus to become a TACCO.

As the two acoustic system operators, SS1 and SS2 are responsible for detecting and classifying acoustic contact gained on active and passive sonobouys. This multiple buoy information is presented to the TACCO along with suggestions on possible target course and speed. The SS1 and SS2 stations are co-located and very similar as they perform the same core task with the SS1 distinguished as the senior of the two only in terms of experience. SS2 is typically in the training syllabus to become a SS1.

The SS3 operates the non-acoustic sensors such as the radar, electronic support measures (ESM), and the magnetic anomaly detector (MAD). He reports information gained on his sensors to the TACCO for target identification and prosecution. Additionally, he reports navigational radar fixes to the NAVCOMM and surface contact information to the flight station.

The IFT is an experienced avionics troubleshooter. As the tactical systems expert, the IFT insures that the avionics equipment is fully operational during pre-flight and replaces or repairs faulty equipment while in-flight.

The diversity among crew member tasks, combined with the relatively large crew size, requires an exceptional amount of crew-coordination. For these reasons, the VP community has typically been at the forefront in crew-coordination training efforts.

1. Differences between active/reserve crewmembers

Although the crew positions are the same for active and reserve squadrons, there are important differences in the experience level of the respective crew members. In most cases each reserve crewmember has served one or more three-year active duty tours in a VP squadron. This has a dramatic effect at the so called 'entry level' positions such as 3P and NAVCOMMs. For example, a reserve pilot may only be assigned as a 3P, yet still have well over 1500 total flight hours in the P-3 and have been a PPC in his last active duty tour. In contrast, a newly assigned 3P in an active squadron typically has only 30 hours in the P-3 and needs a minimum 18 months in further training to become a designated PPC. Similar situations exist for NAVCOMMs, SS2s, and others.

Total flight hours are not the only difference between active duty and reserve

aircrew. Other crew attributes such as time on current crew, time in squadron, and time since initial positional qualification seem to be significantly different. To investigate this hypothesis the four previously mentioned crew attributes were collected on one reserve squadron, VP-91, and one active squadron, VP-10 (Appendix B). The crew attributes were then compared for the 84 reservists versus 84 active personnel.

2. Crew profile comparisons

The months in squadron comparison, shown in figure two, shows that the average reserve crewmember has been in the squadron longer. The average for active crewmembers is 21.4 months while the active crewmembers average 48.8 months onboard.

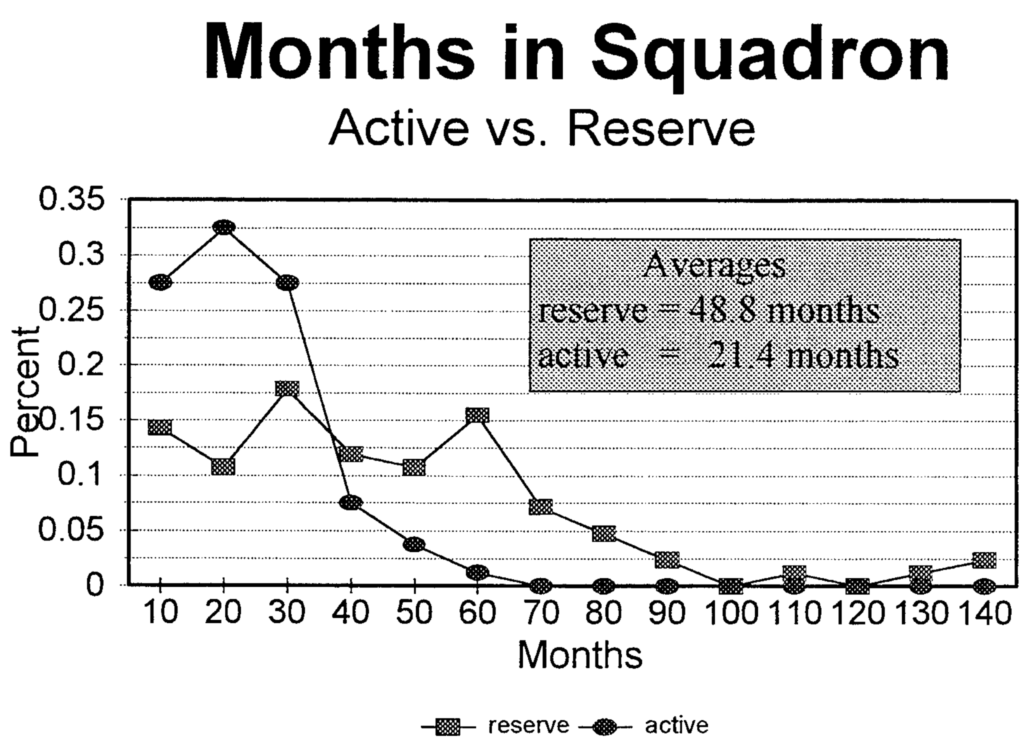


Figure 2

Correspondingly, the time spent on the same crew is longer for reserves as well. The current readiness system's emphasis on crew unity encourages squadrons to leave crews together indefinitely. Figure 3 is a histogram comparing how many months active or reserve crewmembers have been on the same crew. The data collected in the reserve squadron was limited to two years because identifying which crew a person was on only went two years back. In many instances reserve crewmembers have been on the same crew for five or more years so the reported average is low. The average for reservists is still 18.9 months compared to only 6.3 months for active crew members.

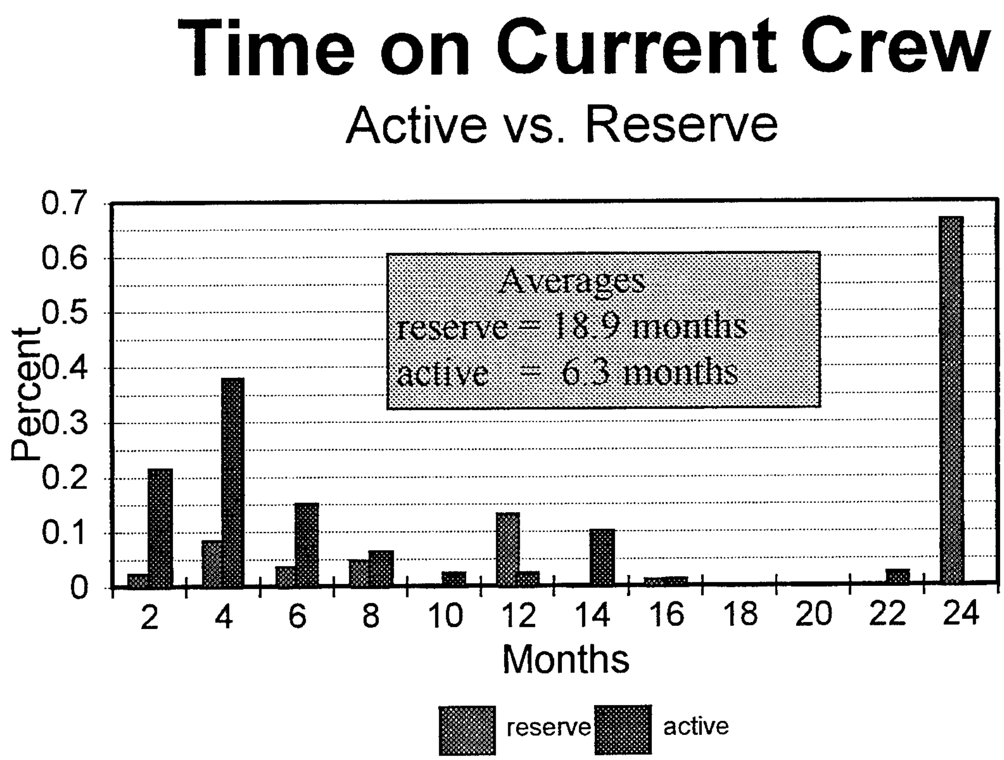


Figure 3

The next two figures present the individual experience level difference between reservists and their active duty counterparts. Figure 4 presents the individual flight hour comparisons between the two squadrons.

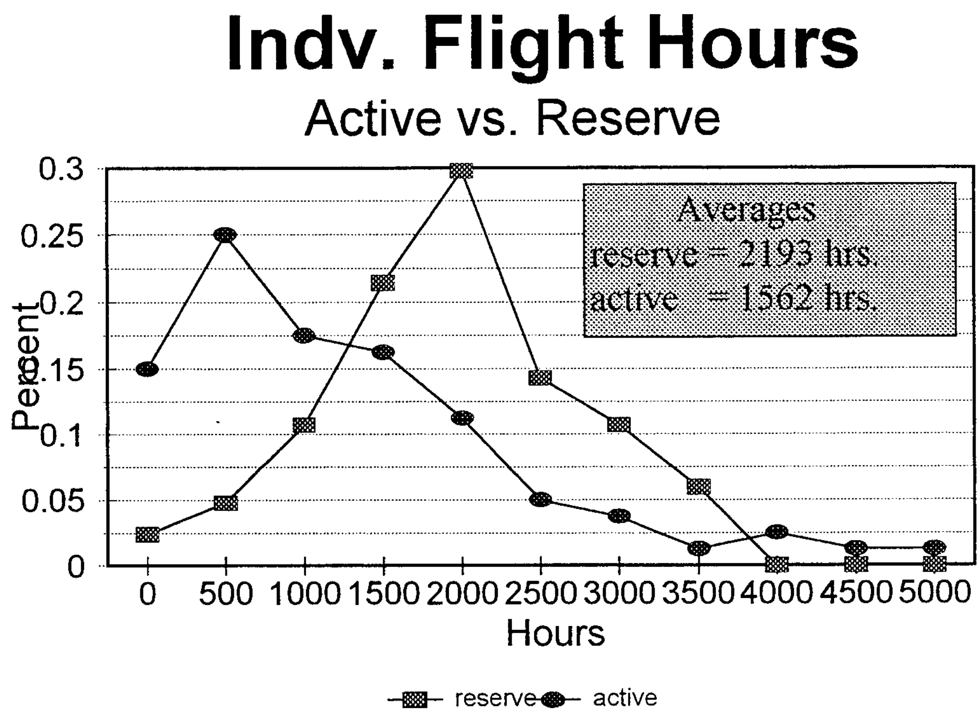
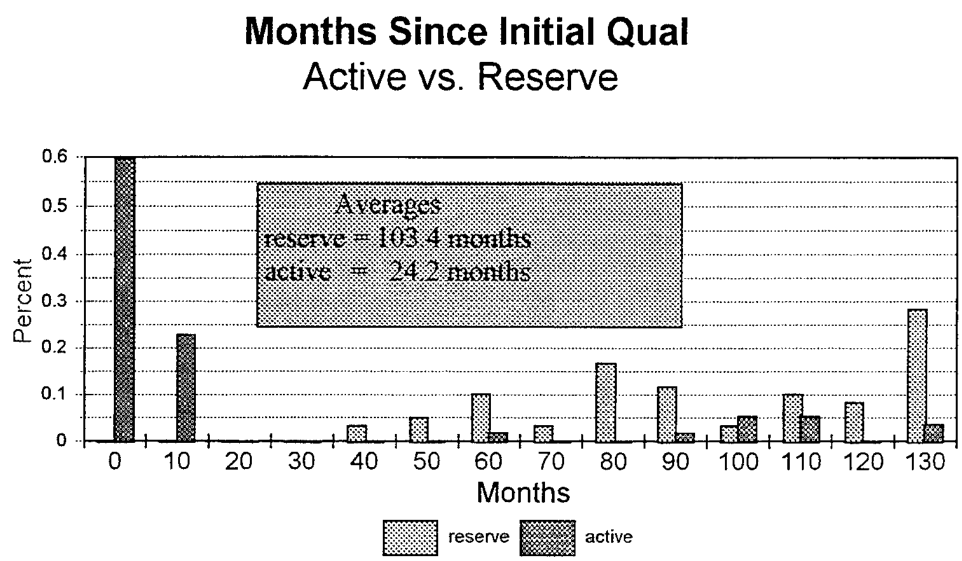


Figure 4

Reservists had a range of 179 to 3,900 flight hours and an average of 2,193 total flight hours. The active squadron average was 1,562 with a wider range of 200 to 5,292 flight hours.

Figure 5 below further breaks down the experience by measuring how many months since their initial positional qualification. This comparison was restricted to the officer positions because many of the enlisted aircrew have come from other aircraft with

the same rating. The difference is large because in an active squadron all of the 3Ps and many of the 2Ps and NAVCOMMs are still upgrading to PPC or TACCO. It typically takes 12 to 18 months for a new 3P or NAVCOMM to become a PPC or TACCO. Conversely, in reserve squadrons all 2Ps, 3Ps, and NAVCOMMs have already attained a



PPC or TACCO qualification in prior active duty tours.

IV. VP READINESS SYSTEM

A. OVERVIEW OF CURRENT SYSTEM

In military units combat readiness simply refers to whether a unit is certified ready for combat. The training aspect of readiness is reported by readiness categories (c-ratings). Training readiness for aircrew is measured in the Navy by mission area. For a multi-mission aircraft, such as the P-3, an individual crewman is considered combat ready in a single mission area, called primary mission areas (PMA), if he gains 75 or more percentage points out of 100. The Naval Air Reserve Force instruction on readiness (COMNAVAIRRESFORINST 3500.54) fits the individual readiness to the squadron level by simply taking a mathematical average of all flight crews in that PMA. The instruction then states that all combat ready aircrew should be formed into *theoretical* crews. Thus the final squadron combat rating comes from calculating the number of combat ready theoretical crews and dividing by the total number of possible crews assigned. This percentage is then used to report a subsequent C-rating as shown below.

C-ratings	C-1	C-2	C-3	C-4
% crews combat ready	85-100%	75-84.9%	65-74.9%	< 65%

Within the VP readiness system there is a much stricter crew composition requirement. Rather than set up theoretical crews after the individual qualifications are complete, the VP system requires that crews gain their qualifications as a formed crew. The VP system focuses on what it calls the crew tactical nucleus (TACNUC), which

consists of the senior pilot (PPC), tactical coordinator (TACCO), senior acoustic systems operator (SS1), and non-acoustic systems operator (SS3).

The VP readiness training matrix itself is a fairly complex mix of 37 events[6] which qualify in seven primary mission areas. The table below shows the primary mission areas (PMAs), what they essentially measure and how many of the 28 reserve readiness events feature that PMA.

PMA	NAME	MEASURES	EVENTS
MOB	crew mobility	non-tactical quals such as instrument check for pilots	7 of 28 / 25%
ASU	anti-surface warfare	ability to detect, track, and engage surface targets	10 of 28 / 35.7%
ASW	anti-submarine warfare	ability to detect, track, and engage sub-surface targets	11 of 28 / 39.3%
MIW	mine warfare	ability to accurately place mines in a hostile or non-hostile environment	5 of 28 / 17.8%
INT	intel/surveillance	full use of onboard systems for intelligence collection and surveillance	17 of 28 / 60.7%
C2W	command and control	ASW skills in a multi-unit coordinated event	12 of 28 / 42.8%
CCC	command, control, and communications	ASU skills in a multi-unit coordinated event	15 of 28 / 53.6%

[6] Reserve squadrons have nine less events due to differences in tactical equipment from their active duty squadron counterparts. For example, reserve squadron aircraft are not maverick missile capable and are not required to complete the associated 'maverick qualification'.

As noted in the event column, a single event may carry points in several PMA areas or focus on only one. Below is an example of two events along with their associated PMA points.

EVENT	ASU	ASW	MIW	MOB	CCC	INT	C2W
C2W2	5	2	5	0	2	3	10
M1W1	0	0	65	0	0	0	10

The way the point spread is distributed, being qualified in the major warfare areas (ASU, ASW, MIW, and INT) tends to carry the other PMA areas (C2W, CCC). [7] The major tactical events are further distinguished by either being an initial qualification or currency qualification. For example, a crew would first fly the ASU 5 for the initial ASU qualification. This qualification is good for three years and requires the TACNUC plus the NAVCOMM. The reserve training instruction describes the crew coordination aspect of initial qualifications with the following note:

> Crew coordination advanced qualification event. This event is conducted as a crew evolution. TACNUC crewmembers required to obtain this crew qualification must be assigned to the crew per the crew list. Crew qualification remains current based on continued integrity of three of four of the crew's TACNUC crewmember composition. (COMRESPATWINGLANT/PACINST 3500.41D II-A-5)

In summary, for initial qualifications the entire TACNUC must be present and the qualification is only good for the entire three year period if three of four TACNUC remain on the crew.

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[7] The MOB PMA is essentially a starting point. A crewmember cannot fly tactically unless his MOB qualifications are current.

The second aspect of advanced qualifications is the currency event. Continuing with the above ASU example, the ASU 6 currency would be flown after the ASU 5. The readiness instruction requires that currency qualifications are flown with at least three of four TACNUC present. Currency qualifications expire after one year.

The scheduling aspect of the TACNUC requirements for both currency qualifications and initial qualifications drive the readiness picture for reserve squadrons. Remember that reservists are only available between one and two weekends per month. Any qualification period lost can mean months before that crew's entire TACNUC is again available on the same day as the training resource needed (i.e. simulator time, range period, or target). Despite the best planning efforts, reserve squadron training officers typically spend the few days before drill weekends trying to find alternative crews and qualifications to schedule in response to last minute TACNUC crewmember absence. In this situation, a training officer often is unable to find an entire alternate crew who is available and needs the particular qualification. Instead, he may opt to reduce an initial qualification to a three of four TACNUC currency qualification or, as a last resort, turn the event into a freeplay, or practice period. In interviews with reserve wing and squadron training officers it is estimated that between 30% to 50% of all scheduled readiness events are changed or canceled due to TACNUC scheduling problems.

With such a large percentage of training events affected, the issue becomes a serious efficiency of resources question. There is often a significant amount of resources dedicated to these training events. Consider the crews from Pt. Mugu, California who must travel to Whidbey Island, Washington for a simulator or a crew from Whidbey that

flies to the torpedo range in Hawaii. Consequently, the TACNUC constraints can have a large impact on the efficient use of valuable training assets.

B. TACTICAL PROFICIENCY COURSE

The tactical proficiency course (TPC) was created in 1993 to standardize tactical communications and increase squadron member's awareness of how each individual crewmember's tasks fit into the overall mission. The course is similar to many CRM- type programs throughout the military and the civilian sector. What does make TPC different is that its primary focus is on mission effectiveness rather than flight safety. TPC's attempts to standardize each crew position so that temporary or permanent crew changes do not effect crew performance. Theoretically, any TPC trained crewmember can walk on to another crew and know exactly what is expected of him, recognize standard tactical phraseology, and communicate effectively with all other crewmembers on the very first flight. Currently the TPC course and its associated qualification events are not formally tied to the readiness system in reserve squadrons.

C. ALTERNATIVES

During the SME interviews, subjects were asked to present some possible changes to the current crew coordination rules that might ease the scheduling difficulties without compromising crew coordination training. The difference between the two resulting alternatives address one of the fundamental questions of this thesis--whether training with a set crew list significantly improves crew coordination and mission effectiveness.

The first alternative is essentially a slight relaxation of the current system's crew coordination rules. The second alternative proposes a much more comprehensive change.

1. Alternative One -- Relaxed TACNUC Rules

In this alternative the currency and initial TACNUC rules are changed from four of four for initial qualifications and three of four for currencies to three of four for initial qualifications and two of four for currencies. This alternative is not a sweeping change. It merely eases some of the scheduling difficulties while embracing the current readiness system's TACNUC requirements..

2. Alternative Two -- Discarded TACNUC Rules

In contrast, alternative two is a sweeping change. Alternative two would discard all TACNUC scheduling requirements and allow all crewmembers to gain their initial and currency qualifications as individuals. Squadron wide readiness would then be computed using the 'theoretical' crew model suggested by COMNAVRESFOR instructions. A key aspect of this alternative is that the new TPC system would be the venue for all crew coordination training and the readiness training schedule would not be subjected to any crew composition constraints.

Below is a summary of the two alternatives and how they address crew coordination:

	Initial Qual	**Currency Qual**	**Crew Coordination**
Current System	4 of 4 TACNUC required	3 of 4 TACNUC required	tied to all readiness qualifications
Alt. One	3 of 4 TACNUC required	2 of 4 TACNUC required	tied to all readiness quals (relaxed)
Alt. Two	no TACNUC req all individual quals	no TACNUC req all individual quals	gained through TPC quals

V. ANALYSIS OF ALTERNATIVES

Through SME interviews the alternatives were analyzed using three criteria; anticipated increase in squadron readiness, possible impact on crew coordination, and political feasibility. The increase in squadron readiness is primarily a measure of increased efficiency. These efficiency gains are then balanced against any perceived loss in crew coordination training.

A. ANTICIPATED INCREASE IN SQUADRON READINESS

Current wing and squadron training officers were asked to estimate the possible percentage increase in squadron readiness for each alternative. The training officers used recent schedules and memories from prior tours to estimate a percentage increase. This estimate ranged from 10-20% increase for the relaxed TACNUC alternative and a 30-40% increase for the discarded TACNUC/individual qualifications alternative. While these estimates may seem like remarkable increases in squadron readiness, the rule changes essentially remeasure what is already there. For example, when a crew composition constraint in the current system forces an unneeded currency or freeplay the training still occurs yet is not measured by the current readiness system. In an extreme case, consider a crew that completes several freeplays to a crew which doesn't do any training during the same period. While both crews have not gained any readiness points on paper, the freeplay crew is certainly more combat ready in real terms. A change in the current system would allow more of these freeplays to become documented readiness qualification events.

In terms of efficiency alone, either alternative looks attractive. However, the anticipated increase in efficiency has to be balanced with any perceived loss in crew coordination. The alternatives must also address possible resistance from the active fleet on readiness points gained under a different system. Both the change in crew coordination and active fleet resistance are difficult to quantify. Yet, both are critical issues concerning any changes to the current system and must be addressed.

B. POSSIBLE IMPACT ON CREW COORDINATION

The impact on crew coordination is arguably the most important aspect of any changes to the current system. Since alternative one is merely a relaxed version of the current system, it is doubtful that it would have a substantial crew coordination impact in either direction. Conversely, alternative two is a fundamental shift in the crew coordination aspect of readiness training and requires careful analysis. This analysis of alternative two is broken into four subareas; new emphasis on TPC/ACT, real world operations, reserve vs. active crew attributes, and current crew coordination research.

1. New Emphasis on TPC and ACT Programs

The current readiness system is not the only VP training program which addresses crew coordination. As discussed in chapter IV, the TPC system attempts to standardize the tactical crew's interaction. The aircrew coordination training (ACT) also attempts to standardize crew interaction in terms of flight safety. The emphasis on both programs has increased since the new readiness system was adopted. TPC is now required for all crews and consists of 20 hours of classroom time followed by three simulators flown as a crew. Many SME interviewees mentioned that the requirements associated with each separate

program seemed like a "duplication of effort". With crew coordination being addressed in both TPC and ACT, training officers felt some of the crew composition constraints of the readiness system were unnecessary, especially when considering the severe scheduling problems they create.

Additionally, the TPC and ACT approach to crew coordination seem be in conflict with the approach taken by the readiness system. TPC and ACT emphasis standard phraseology, standard positional tasks, and general teamwork. A TPC and ACT trained crewmember is expected to perform his job and interact with other crewmembers the same, regardless of what crew he is flying with. On the other hand, the current readiness system treasures crew unity as if the interactions and individual tasks performed by each crewmember are unique to a particular crew.

2. Real World Operations

SMEs pointed out that crew composition requirements do not reflect how crews actually operate in the real-world environment. Currently there are no crew composition requirements or TACNUC rules concerning operational flights. While the training environment now dictates that crews fly exclusively as TACNUC units, real-world operations often force squadrons to schedule by individual qualifications. As an example, consider an active duty squadron on deployment. If the TACCO of a crew gets sick and is unable to fly his crew is not taken off the schedule, instead, another qualified TACCO fills in and the crew flies the mission minus one TACNUC. A few such substitutions combined with strict crew rest requirements can lead to a situation where many crews are flying with mixed crews for several days. While mixed crews have become an operational scheduling

necessity, few have complained that it decreases mission performance. In fact, one of the only motivators to get a crew back together is the possibility of getting some readiness qualifications during future operational events.

For reservists the most visible example of the "real-world ops" argument is the performance of reserve crews in Operation Desert Shield / Storm. The two reserve crews which participated were made up of volunteers from several crews and had not completed readiness training as TACNUC crews. These mixed crews performed extremely well as noted by the Commander Patrol Wings Pacific at the time,

> ...I want to lay down an early marker that says our Reserves played a substantive role early and throughout this historic confrontation...you all performed superbly...all did exactly as I knew they would - they worked hard, they were completely professional and they were easily integrated into our active force operations...(Rear Admiral A. R. Maness, COMMPATWINGSPAC message DTG 132355Z March 1991)

Reserve participation in future conflicts will probably see the same mixed crew approach since reservists who offer voluntary recall are often available sooner than an official Presidential recall of reserves.

The mismatch of crew composition requirements in readiness training and the scheduling reality that reserves and active forces face was mentioned by many SMEs. Interviewees often mentioned the phrase, 'let's train the way we fly" to convey how the readiness system's crew composition constraints do not reflect the actual combat readiness it is designed to measure.

3. Crew Attribute Differences

As discussed in chapter three, the differences between active and reserve crews

total flight time, time on crew, time since initial qualification, etc. all point out the vast experience level a typical reserve crew has. An important aspect of this experience is that flying on a crew is not a new thing for most reservists as it is for an active duty crewmember. For example, active duty 3Ps and NAVCOMMs are typically fresh from positional technical training and have little experience in flying on a crew. Conversely, a typical reserve 3P or NAVCOMM has already served one or more active duty tours and has several hundred hours of flying experience in a crew environment. The significant difference in crew experience may mean that reservists gain little from TACNUC requirements that were designed introduce the crew concept to active duty crewmembers.

4. Current Research

Recent crew composition research, as detailed in chapter two, suggests that battle rostering can have a negative impact on mission effectiveness and safety. The negative impact may be even more pronounced for reserve crews for two reasons. First, reserve crews tend to stay together as a crew much longer than their active duty counterparts (Figure 3). Second, a reserve crew flies much less non-crew events than an active duty crew since a higher percentage of reserve flights are devoted specifically to readiness training. This means reserve crews, under the current readiness system, are much further to the right on the familiarity cycle and could have a higher tendency of complacency and overconfidence.

C. POLITICAL FEASIBILITY

Political feasibility of each option is an essential issue. The necessity for active forces to identify with and accept reserve training methods may preclude creating a system

unique to the reserves. For this reason, alternative one can be viewed as the least disruptive to the status quo. Gaining commands would continue to identify with the TACNUC aspect of alternative one. Alternative one's relaxed TACNUC rules are a simple compromise between having the exact readiness system as the active forces and increasing the efficiency of reserve readiness scheduling.

Alternative two would certainly impact the status quo more. With a distinctly different readiness system, in terms of crew coordination, some would undoubtedly question the equity of a combat ready reserve crew vs. a combat ready active crew. In the case of alternative two, a dilemma between "efficient use of crews/assets vs. mirroring the fleet's training requirements" emerges. Both efficient use of resources and similarity to the fleet requirements are desired in reserve training as indicated in the Naval Reserve Force strategic plan,

> Efficiency ---...We will pursue innovative technologies and methodologies to provide the best education and training and most efficient cost for our personnel from affiliation to retirement...
>
> Similarity --- ...We will continue to refine our Training Plans to meet Active Component training requirements...
> (www.ncts.navy.mil/nabresfor/stratei.html)

Closely following the TACNUC requirements used by fleet active forces has created an unintended resource inefficiency in the reserve readiness qualification process. In this case, there seems to be a choice, or at least a balance, between similarity and efficiency.

VI. CONCLUSIONS AND RECOMMENDATIONS

The current VP readiness system's TACNUC rules are creating serious scheduling constraints for all VP reserve squadrons. These constraints have a great impact on efficient use of valuable training resources. Through SME interviews, the estimated the number of events affected by TACNUC rules are between 30% to 50%. Each affected event must be rescheduled in one of the following ways:

- event is changed to another crew
- event is reduced from a full TACNUC 3 year qualification to a 3 of 4 TACNUC 1 year currency qualification
- event becomes a freeplay practice session for the remaining available crewmembers
- event is canceled

In each case above, the squadron training officer is forced to chose an option that is lower on his training priority list and has less benefit for squadron readiness. The resulting resource inefficiencies might be acceptable if the subsequent crew coordination training, safety of operations, and mission effectiveness were all tied to using permanently formed crews. However, current crew coordination research in the Army and Air Force indicate that both safety and mission effectiveness decrease during long-term fixed crew operations.

Accordingly, the VP readiness system's TACNUC rules should be abandoned in favor of an individually based qualification system which measures whole squadron

readiness by forming 'theoretical' crews. With an individual qualification system, crew coordination training will still be addressed through the existing TPC and ACT programs. TPC and ACT are recognized as valuable training methods for standardizing positional tasks, improving crew communication, and fostering teamwork. Moving to an individually based qualification system would eliminate the current conflict between TPC and ACT standardized training and the current readiness system's emphasis on crew unique skills. Using an individual system is also expected to increase overall squadron readiness levels by 30% to 40% according to SME interviews.

A. FURTHER RESEARCH

As an interim step, a new individual readiness system should be pilot tested in one squadron. After several months, this squadron could participate in a WST/OFT 'fly-off' versus a reserve squadron still using the current system. Grading should be performed by active duty wing instructors unaware of the participating crew's different readiness systems. Using active duty wing instructors would also facilitate credibility with the active duty equity issue.

Further research should attempt to correlate past crewmember experience with crew coordination requirements. Also, a determination of the typical point where crew overconfidence and complacency overrides the short term positive effects of familiarity would be useful.

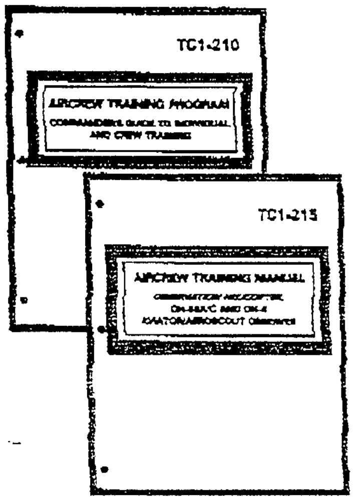
The crew system has a long history in patrol squadron aviation. While one study may not be enough evidence to change a policy, the current crew coordination research and SME testimony presented in this thesis should open the VP crew composition debate.

APPENDIX A. ARMY POLICY CHANGE

Crew readiness level progression for battle-rostered crews

According to U.S. Army Aviation Center (USAAVNC) message dated 251200Z Feb 94, crew readiness levels (CRLs) no longer apply to aircrew training programs. All references to CRL will be deleted with the next change to TC 1-210: Aircrew Training Program, Commander's Guide to Individual and Crew Training scheduled for first quarter of FY 95.

Commanders are no longer required to battle roster crewmembers regardless of FAC level. However, they may still choose to battle roster crews at their discretion.



Commanders should note that a recent study of AH-64 crews by the U.S. Army Research Institute revealed that battle rostering had minimal effect on overall mission performance and flight safety for crews who have completed the Army's exportable training packet for crew coordination. Study data showed battle rostering had mixed results in some instances: gunnery performance improved with battle rostering, but crews tended to exhibit more complacency, overconfidence, and nonstandard coordination procedures in the cockpit.

The requirement in TC 1-215: Aircrew Training Manual, Observation Helicopter, for an aerial observer (AO) and aerial fire support observer (AFSO) to be battle rostered with a pilot-in-command (PC) for the purpose of emergency aircraft handling training is rescinded. The commander will designate in writing PCs to conduct emergency handling training with AOs/AFSOs.

Crew coordination training

The Army is still conducting crew coordination training, which is separate and distinct from crew readiness levels and battle rostering. This training is seen as the most effective solution for improving crew coordination. Commanders are required to implement the Aircrew Coordination Training Program in accordance with USAAVNC message 201630Z Jul 93, subject: Aircrew Coordination Training Program.

The USAAVNC point of contact for crew coordination training is CW5 Rodney Rowe or CW4 Jim Winston, Aviation Training Brigade, DSN 558-9545/2238 (205-255-9545/2238).

—MAJ Jose R. Arroyo, USAAVNC Directorate of Evaluation and Standardization, DSN 558-2603 (205-255-2603)

APPENDIX B. CREW ATTRIBUTES

		CREW	FLT HRS	SQUAD	QUAL
	PPC	5	3066	Jul-96	Jul-88
	2P	5	807	Jun-95	Mar-82
	3P	5	301	Sep-96	upgrading
crew 1	TACCO	5	1998	Aug-96	May-87
	NAV	5	896	May-95	upgrading
	SS1	5	3212	Oct-93	
	SS3	5	392	Nov-96	
	PPC	16	1277	Oct-94	Jan-83
	2P	4	752	Sep-95	Feb-96
	3P	1	624	Jan-97	upgrading
crew 2	TACCO	4	1291	Oct-96	Nov-95
	NAV	4	939	Jun-95	Feb-97
	SS1	4	1771	Jan-93	
	SS3	4	5292	Jun-95	
	PPC	14	1158	Sep-94	Mar-96
	2P	4	883	May-95	Feb-97
	3P	4	306	Jun-96	upgrading
crew 3	TACCO	4	1606	Aug-94	Nov-95
	NAV	4	1107	Aug-96	Jul-96
	SS1	4	2477	Aug-93	
	SS3	4	1399	Mar-95	
	PPC	4	1467	Jul-94	Dec-95
	2P	4	685	Oct-95	Jan-96
	3P	****	*******	*******	*******
crew 4	TACCO	4	1557	Mar-94	Oct-95
	NAV	4	190	Oct-96	Dec-95
	SS1	4	1643	Oct-93	
	SS3	4	4321	May-93	
	PPC	3	1266	May-94	Dec-96
	2P	3	710	Jul-96	upgrading
	3P	3	407	Jun-96	upgrading
crew 5	TACCO	3	1080	Nov-94	Mar-96
	NAV	3	796	Nov-95	upgrading
	SS1	3	1925	Mar-95	
	SS3	3	2923	Oct-94	
	PPC	6	2950	Jun-96	Feb-92
	2P	6	906	Mar-95	Jan-97
	3P	3	739	Feb-96	upgrading
crew 6	TACCO	6	2144	Jun-95	Dec-88
	NAV	6	459	Jul-95	upgrading
	SS1	6	3010	May-94	
	SS3	6	3843	Jul-94	

		CREW	FLT HRS	SQUAD	QUAL
	PPC	14	1280	Dec-94	Nov-96
	2P	10	999	Jan-95	upgrading
	3P	6	750	Jul-96	upgrading
crew 7	TACCO	6	1778	Aug-96	Apr-88
	NAV	6	1761	Aug-94	upgrading
	SS1	6	4130	Sep-93	
	SS3	6	1987	Feb-94	
	PPC	2	1044	Nov-94	Oct-96
	2P	****	*******	*******	*******
	3P	2	258	Jul-96	upgrading
crew 8	TACCO	2	2494	Nov-94	May-96
	NAV	2	784	Jun-96	upgrading
	SS1	2	2442	Sep-92	
	SS3	2	2120	Jun-95	
	PPC	14	1484	May-94	Jan-96
	2P	14	906	Jun-95	upgrading
	3P	5	496	Jan-96	upgrading
crew 9	TACCO	14	1553	Sep-94	Oct-95
	NAV	8	390	Apr-96	upgrading
	SS1	14	1955	Jun-95	
	SS3	14	2980	Jul-95	
	PPC	4	1248	Jun-96	May-96
	2P	4	499	Jul-96	upgrading
	3P	4	566	Jul-96	upgrading
crew 10	TACCO	4	1438	May-94	Feb-96
	NAV	4	206	Apr-96	upgrading
	SS1	4	2071	Jun-94	
	SS3	4	2027	Dec-92	
	PPC	8	4954	Jun-96	Mar-87
	2P	8	685	Dec-95	upgrading
	3P	****	*******	*******	*******
crew 11	TACCO	23	1402	Mar-94	Oct-95
	NAV	8	762	Sep-95	upgrading
	SS1	23	1992	Feb-92	
	SS3	8	1543	Jan-96	
	PPC	12	2438	Feb-96	Aug-88
	2P	7	892	Feb-95	Dec-96
	3P	****	*******	*******	*******
crew 12	TACCO	12	2145	Jan-96	Oct-87
	NAV	10	628	Nov-95	Feb-97
	SS1	14	2879	Jun-94	
	SS3	3	450	Jan-96	

VP-10
ACTIVE

CREW = time in months on current crew
FLT HRS = total individual flight hours
SQUAD = date assigned to current squadron
QUAL = date attained current positional qual
**** = position not currently filled

VP-91 Crew Attributes

		CREW	FLT HRS	SQUAD	QUAL
	PPC	24	2270	Sep-93	Jan-90
	2P	24	2245	Sep-93	Dec-88
	3P	24	2923	Feb-95	May-87
crew 1	TACCO	9	2254	Aug-94	Oct-88
	NAV	7	1720	Aug-96	May-89
	SS1	7	1340	Mar-89	Nov-91
	SS3	24	1525	Aug-94	Oct-94
	PPC	24	2466	Apr-90	Apr-86
	2P	5	2542	Apr-93	Nov-87
	3P	3	2551	Dec-96	May-92
crew 2	TACCO	24	3050	Nov-89	Oct-85
	NAV	24	992	Apr-94	Mar-84
	SS1	8	3496	Dec-83	Apr-84
	SS3	24	1818	Oct-93	Jun-94
	PPC	24	2300	Oct-94	Mar-90
	2P	24	1782	Nov-92	Feb-90
	3P	24	2788	Nov-92	Jan-88
crew 3	TACCO	24	2685	Jul-91	Jul-85
	NAV	24	2594	May-90	Dec-85
	SS1	24	1793	Sep-84	Sep-84
	SS3	24	3910	Sep-91	Sep-84
	PPC	24	3927	Sep-91	Jan-86
	2P	24	2262	Jul-92	Jun-89
	3P	4	2050	Nov-96	Mar-92
crew 4	TACCO	24	2370	Dec-95	Nov-88
	NAV	24	1344	Oct-90	Oct-84
	SS1	24	1520	Apr-94	Jun-87
	SS3	24	2520	Jul-91	May-87
	PPC	12	1953	Feb-95	Jun-90
	2P	12	2243	May-93	Aug-89
	3P	12	1761	May-94	Aug-89
crew 5	TACCO	12	1853	Sep-95	Dec-89
	NAV	12	2010	Nov-95	Dec-89
	SS1	12	1000	Oct-95	Jun-87
	SS3	12	3352	Aug-90	May-87
	PPC	24	3164	Oct-91	Mar-85
	2P	24	1611	Jan-95	Jan-90
	3P	24	2263	Mar-94	Jul-90
crew 6	TACCO	7	1125	Aug-96	Feb-93
	NAV	12	2385	May-94	May-86
	SS1	24	1577	Mar-96	Sep-86
	SS3	24	3884	Sep-88	Aug-89

		CREW	FLT HRS	SQUAD	QUAL
	PPC	24	3087	Oct-91	May-86
	2P	24	2831	Dec-91	Dec-84
	3P	24	1797	Sep-92	Sep-90
crew 7	TACCO	24	2290	Feb-93	Apr-86
	NAV	24	856	Mar-91	Aug-91
	SS1	8	3041	Jun-96	Aug-87
	SS3	3	1850	Oct-96	Jun-88
	PPC	24	2353	Apr-92	Sep-87
	2P	24	3191	Mar-94	Dec-86
	3P	24	2100	Sep-93	Jul-92
crew 8	TACCO	24	2922	Feb-95	Nov-86
	NAV	24	1311	May-95	Aug-90
	SS1	24	755	May-91	Mar-92
	SS3	24	1127	Mar-95	Sep-92
	PPC	24	1028	Oct-91	Jun-85
	2P	24	2466	Dec-90	Dec-87
	3P	24	1400	Oct-91	Mar-87
crew 9	TACCO	24	2821	Aug-91	Dec-86
	NAV	24	3200	Mar-90	Apr-82
	SS1	24	1445	May-86	Aug-87
	SS3	24	3165	Jun-93	Apr-90
	PPC	24	3916	Sep-91	Sep-85
	2P	24	2300	Nov-92	Dec-89
	3P	13	1861	Jan-96	Aug-92
crew 10	TACCO	8	2465	Aug-96	Aug-89
	NAV	5	2067	Aug-96	Jan-92
	SS1	6	157	Jul-96	Oct-95
	SS3	24	179	Dec-96	Feb-83
	PPC	24	2773	Jul-91	Jan-88
	2P	17	2474	Jan-93	Sep-89
	3P	12	2131	Jan-95	Jul-93
crew 11	TACCO	24	2331	Oct-89	Mar-85
	NAV	24	3528	May-94	Feb-92
	SS1	24	2122	Dec-77	Jun-81
	SS3	24	727	Oct-92	Nov-92
	PPC	24	1995	Aug-93	Mar-90
	2P	6	2311	Feb-96	Oct-91
	3P	5	1842	Oct-96	Sep-91
crew 12	TACCO	24	1754	Aug-89	Aug-84
	NAV	5	2356	Oct-96	Jul-86
	SS1	13	1980	Jul-95	Jun-89
	SS3	24	2725	Nov-94	Dec-87

VP-91
RESERVE

CREW = time in months on current crew
FLT HRS = total individual flight hours
SQUAD = date assigned to current squadron
QUAL = date attained current positional qual

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